HDI™
ISO 9001:2000

M100 Precision Pressure Gauge

User's Manual

713-688-8555

www.houstondigital.com

Manual M100HUA

Hammer Union Models

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For application assistance, current specifications, or the name of the nearest Authorized Distributor, check the HDI website or call 713-688-8555.

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1 Introduction

HDI offers a complete line of standard service and sour gas electronic pressure measurement gauges for high pressure drilling, well servicing, and production applications.

The M100 Electronic Pressure Gauge has been manufactured for use in the oilfield. It is a direct replacement for existing gauges and can be mounted on existing fittings. The M100 is designed to give many years of trouble-free service. Its display and electronics package are mounted in shock absorbing material and can survive severe shock and vibration. Its durable case is constructed of shock and vibration dampening material, which supplies further protection to internal components. The pressure fitting and base insert are constructed of corrosion resistant stainless steel. Its performance is based around a precision micromachined piezoresistive silicon chip that is protected by a stainless steel housing, which is filled with silicone oil. This configuration transfers pressure from the diaphragm to the silicon chip with a high degree of accuracy and stability. The M100 is powered by a sealed intrinsically safe internal battery with a life of one year of continuous operation. The battery is field replaceable and a low battery icon illuminates when there are less than 30 days of battery life remaining.

The M100 provides the operator with a local pressure data display, which is unavailable when pressure transmitters alone are employed. When operated with the data output feature, the M100 provides both a local data display and a data transmitter for a centralized data acquisition computer. The M100 can also provide a remote readout data display as an option.

This manual provides information on operating and maintaining the M100 Electronic Pressure Gauge. The sections are organized as follows:

2: Description contains an overview of the M100.

3: Operation and Maintenance provides operating instructions, software functions, and configuration parameters.

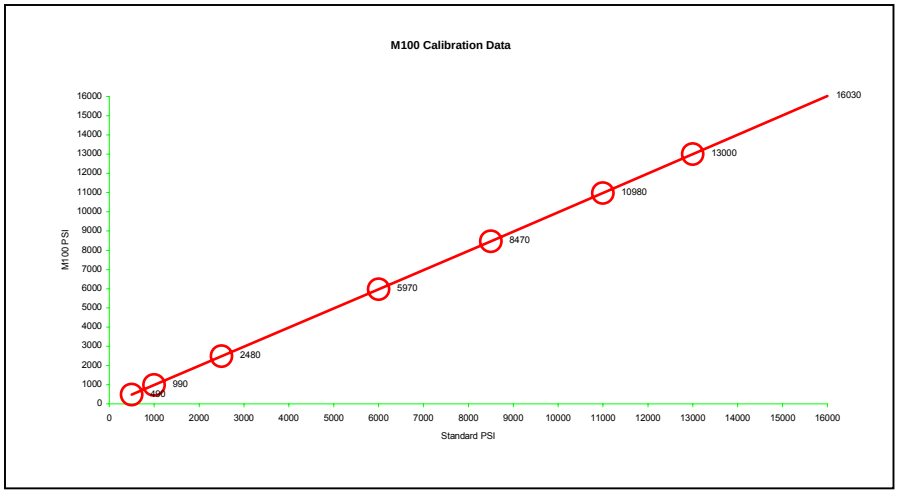
Appendix A: Reference Data supplies reference and specification data.

2 Description

2.0 Overview

The M100 is a battery powered electronic gauge that measures and displays pressure as both a digital number and as a circular analog bar graph trend indicator. The M100 standard pressure ranges are 0 to 6,000 PSIG, 0 to 10,000 PSIG, and 0 to 16,000 PSIG. The measurement resolution of the M100 is less than one psi. Due to industry preference, displayed pressure resolution is ±10 psi. Measurement accuracy is better than 0.5% of full scale. The measurement is compensated for temperature over the range of –10 to +80°C. Every M100 is calibrated at the HDI Laboratory using HDI's NIST Standard Pressure Calibrator. A typical M100 calibration graph is shown below.

Standard PSI	Measured PSI	%FS
500	490	-0.0625
1000	990	-0.0625
2500	2480	-0.1250
6000	5970	-0.1875
8500	8470	-0.1875
11000	10980	-0.1250
13000	13000	0.0000
16000	16030	0.1875



2.1 Standard Hammer Union Model Numbers

► 1502 Hammer Union
► 2202 Hammer Union

M100 Hammer Union Part Numbers

PART NO.	RANGE	HAMMER UNION	SERVICE
M100YS-06K1502S	6,000 PSI	1502 BLUE	STANDARD
M100YS-10K1502S	10,000 PSI	1502 BLUE	STANDARD
M100YS-16K1502S	16,000 PSI	1502 BLUE	STANDARD
M100YS-06K1502H	6,000 PSI	1502 GREEN	H2S
M100YS-10K1502H	10,000 PSI	1502 GREEN	H2S
M100YS-16K2202H	16,000 PSI	2202 GREEN	H2S
M100YS-45K1502S	45,000 KPA	1502 BLUE	STANDARD
M100YS-45K1502H	45,000 KPA	1502 GREEN	H2S

2.2 M100 Model Numbering

Example

1	2	3	-	4	5	6	7
M100	Y	S	-	06K	1502	S	A

OPTION DESCRIPTIONS

1 Model

M100

2 Color

Y = Yellow

3 Display

S = Sunlight Readable
B = Backlight - Battery Powered With Light Detector On/Off

4 Pressure Range

06K	0 to 6,000 PSIG
10K	0 to 10,000 PSIG
16K	0 to 16,000 PSIG
45K	0 to 45,000 kPa

5 Pressure Connection

1502	1502 Hammer Union
2202	2202 Hammer Union
2M1F	Combined 2-inch Male NPT and 1-inch Female NPT
001G	One Inch 1502 Guiberson
105M	1-13/16 Inch 5M Flange
110M	1-13/16 Inch 10M Flange
115M	1-13/16 Inch 15M Flange
205M	2-1/16 Inch 5M Flange
210M	2-1/16 Inch 10M Flange
215M	2-1/16 Inch 15M Flange

6 Service

S = Standard Service
H = H2S Sour Gas Service

7 Data Output

A = 4/20 MA Current Loop Output (5000V Isolation)

2.3 M100 Display

The Liquid Crystal Display (LCD) is protected from physical damage by a ¼ inch thick clear plastic lens.All electronic components, including switches, are located inside the case. Removing the rear cover allows access to the battery pack, the power connector, and the calibrator switchboard. Figure 1 is a drawing of the M100 display, which shows the divided scale, analog bar graph, low battery icon, and the digital pressure display.

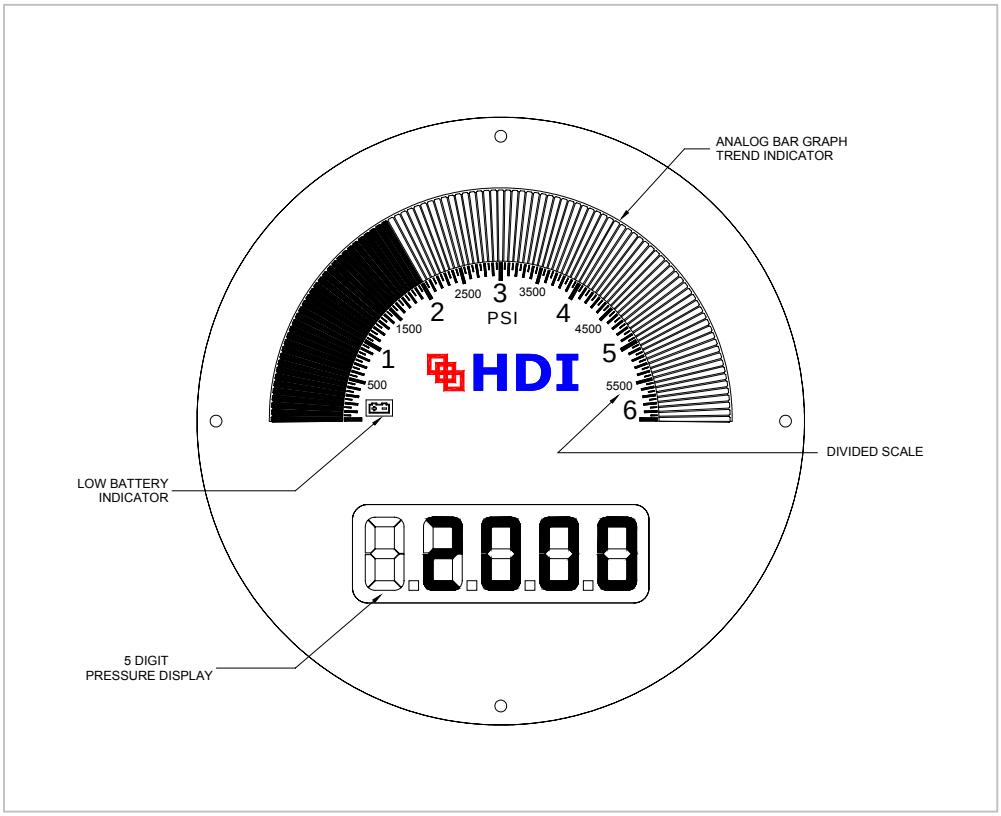


Figure 1 - M100 Display

A unique feature of HDI's M100 Pressure Meter is the analog bar graph. Unlike other digital meters, the M100 offers both a digital and an analog readout of the measured pressure. The analog display mimics a traditional meter display allowing the user to quickly determine where the measured pressure is positioned on the meter scale. The digital display offers the high precision and accuracy expected from a state-of-the-art electronic pressure measurement instrument. The divided scale allows the user to pinpoint the analog bar graph reading, while the 5-digit digital display shows the pressure reading to within 10 psi resolution.

2.4 Analog Meter Simulation

Analog meter movement is simulated with a 101-segment analog bar graph trend indicator.

2.5 Measurement Units

The units of measurement (such as PSIG) are presented on the divided scale.

2.6 Digital Pressure Display

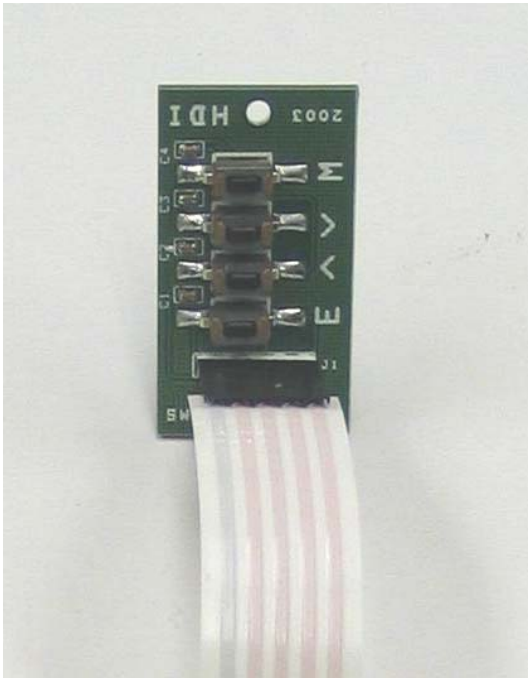
The digital pressure measurement is presented by a large 5-digit seven - segment display, which is located below the analog bar graph.

2.7 Low Battery Indicator

A low battery indicator icon is located on the right side of the minimum part of the scale of the analog bar graph.

2.8 Calibrator Board Control Switches

Access to the calibrator board is obtained by removing the rear cover. There are 4 control switches located on the calibrator board. The switches are identified as **E** (Enter), ▲ (Up), ▼ (Down), and **M** (Mode).



3 Operation

3.0 Installation

There are ten commonly used pressure connections available for use with the M100. This manual applies to the 2-inch 1502 and 2202 hammer union connections used in standard service and H2S sour gas service. The hammer union configuration allows the M100 to be used safely over its three standard pressure ranges. For standard service, the wing nut is painted dark blue. For sour gas service, the wing nut is painted with a green zinc-chromate primer. It is possible to interchange sour gas parts with standard service products. Users must adopt safe practices for identification, installation, use, maintenance, and storage of sour gas equipment.

3.1 Pressure Connections - Standard Service

For standard service, the M100 is available in three pressure ranges:

Model	Rating
M100YS_06K1502	6,000 PSI
M100YS_10K1502	10,000 PSI
M100YS_16K1502	16,000 PSI

All three models are supplied with a 2-inch 1502 hammer union wing nut. The nut is rated for 15,000 psi cold working pressure and tested at 22,500 psi for standard service. The nut is painted dark blue with "15000 CWP FMC Weco 2" FIG 1502" markings.

1502 Standard Service 2-Inch Nut

3.2 Pressure Connections - Sour Gas - 6,000 and 10,000 PSI

For sour gas service, the M100 is available in three pressure ranges:

Model	Rating
M100YH_06K1502	6,000 PSI
M100YH_10K1502	10,000 PSI
M100YH_16K1502	16,000 PSI

For 10,000 psi and below the M100 is supplied with a 2-inch 1502 hammer union wing nut. The nut is rated for 10,000 psi cold working pressure and tested at 15,000 psi for sour gas service. The nut is painted green with "10000 CWP FMC Weco 2" Sour Gas 1502" markings.

1502 H^2S Sour Gas Service 2-Inch Nut

3.3 Pressure Connection - Sour Gas - 16,000 PSI

For 16,000 psi the M100 is supplied with a 2-inch 2202 hammer union wing nut. The nut is rated for 15,000 psi cold working pressure and tested at 22,500 psi for sour gas service. The nut is painted green with "15000 CWP 2" Sour Gas 2202 FMC" markings.

2202 H^2S Sour Gas Service 2-Inch Nut

3.4 Dangers Of Sour Gas

The following information concerning H_2S *sour gas is quoted from the FMC Energy Systems website:*

"Hydrogen sulfide (H_2S) is found in many oil and gas formations. Hydrogen sulfide is highly toxic, colorless, and heavier than air. It has a characteristic foul odor of rotten eggs. Gas containing hydrogen sulfide is commonly referred to as sour gas. Many oilfield injuries and fatalities can be traced to sour gas. Prolonged exposure to low concentrations of sour gas will dull the sense of smell and cause eye and respiratory irritation. In moderate concentrations, loss of balance and reasoning ability will occur. At high concentrations, (H_2S) deadens the sense of smell, preventing detection of the deadly gas and paralyzing the lung muscles. This lethal situation has resulted in many deaths. Pressure-containing components are vulnerable to sulfide stress cracking (SSC) when exposed to sour environments and can lead to various modes of material failure depending on additional environmental conditions. Material damage can occur in a relatively short time frame and can lead to catastrophic failure of the equipment. To prevent material failure and the potential release of highly toxic gases, it is necessary to design metallic components to resist SSC. Guidelines for controlling SSC have been established by the National Association of Corrosion Engineers (NACE). These guidelines are published in NACE Standard MR-01-75. Additional guidelines are published by the American Petroleum Institute (API)in API RP-14E. Sour gas equipment should be specified when there is a possibility that operating conditions will fall within the parameters established.

FMC Fluid Control manufactures Weco sour gas wing unions from 2" thru 6" diameter to 15,000-PSI CWP in accordance with the National Association of Corrosion Engineers (NACE) Standard MR-01-75and American Petroleum Institute (API)Standard RP-14E. These outstanding, field proven unions are specially heat treated for controlled hardness. For fast, sure identification, each Weco sour gas union is stamped "sour gas" using low-stress dot stamping and painted with a green zinc-chromate primer that is unique to sour gas equipment. FMC Fluid Control uses fluoroelastomer seals or O-rings in all sour gas unions, but does not warrant the performance of any elastomer for sour gas service."

3.5 Low Calibration

The M100 gauge will power up in the **Run** mode upon connecting the battery cable.

In the **Run** mode, the gauge will display the Engineering Units (PSIG), the measured pressure, and the analog bar trend graph.

In either the **Low** or **Hi Calibration** modes, the factory calibration settings can be changed.

The gauge will enter the **Low Calibration** mode by performing the following sequence:

a. Remove rear cap and access the calibration board.
b. Press and release the **M** button.
c. Press and release the **M** button a second time.
d. Now the units display will change to read **LCAL**, the pressure display will read **0**, and the bar graph will become inactive.
e. Loosen the hammer union wing nut so that zero pressure is applied to the sensor.

! CAUTION

Unless the transducer is replaced or the system fails, the Calibration mode should not be entered.

It is easy to alter the gauge operating characteristics in this mode leading to incorrect pressure measurement.

f. With zero psi applied, use the ▲ (Up) or ▼ (Down) button to adjust the zero set point, then press the **E** (Enter) button and the new zero psi point will be stored in memory. The gauge will return to normal display mode.

3.6 High Calibration

The gauge will enter the **High Calibration** mode by performing the following sequence:

a. Remove rear cap and access the calibration board.
b. Press and release the **M** button.
c. Press and release the **M** button a second time.
d. Press and release the **M** button a third time.
e. The units display will now read "HCAL", the pressure display will display the maximum psi set point (typically 16,000 psi), and the analog bar graph will be inactive. Pressurize the gauge to full scale (16,000 psi) pressure and use the ▲ (Up) or ▼ (Down) button to adjust the set point to maximum psi. Now press the **E** (Enter) button and the new maximum psi point will be stored in memory.

Install rear cap to return to service.

! CAUTION

After the customer performs the re-calibration described above, HDI will no longer guarantee the accuracy of the gauge.

3.7 Restoring Factory Calibration

The M100 gauge has the capability to retrieve its factory settings for zero set point and maximum set point.

The gauge will retrieve its **Low** and **High Calibration** settings by performing the following sequence:

a. Remove rear cap and access the calibration board.
b. Disconnect the battery.
c. Press and hold the **E** button while reconnecting the battery.
d. Once the gauge powers up, release the **E** button.

Factory settings have now been restored.

Install rear cap to return to service.

3.8 Cleaning The Protective Plastic Lens

The M100 gauge front protection lens is manufactured from Lexan. Avoid contact with liquids such as adhesives, paints, solvents, benzene, gasoline, acetone, or carbon tetrachloride. The front of the lens can be cleaned with lexan cleaner or dishwashing liquid. Below is a photo of the lens before installation. It is not necessary to remove the lens before cleaning.

3.9 Battery Replacement

Remove the rear cap. The battery connector will then be visible and can be disconnected. Replace with a new HDI battery pack. Replace the rear foam vibration isolator and reconnect the battery. Lubricate the rear cap screw threads with Lubriplate or similar type grease and replace.

3.10 Primary Diaphragm Replacement

The primary diaphragm is used to protect the pressure sensor from cement and other similar fluids. Replace the primary diaphragm as needed.

Appendix A: Reference Data

Replacement Parts - Model 100

Part No.	Description
M100KIT 1	Sensor Protection Primary Diaphragm
M100KIT 2	Sensor Protection Secondary Diaphragm Replacement Kit
M100KIT 3	Sensor Replacement Kit - 16,000 psi
M100KIT 4	Sensor Replacement Kit - 10,000 psi
M100KIT 5	Sensor Replacement Kit - 5,000 psi
M1001502S	Wing Nut - Two Inch Weco Hammer Union - Standard - Blue
M1001502H	Wing Nut - Two Inch Weco Hammer Union - Sour Gas - Green
M1002202H	Wing Nut - Two Inch Weco Hammer Union - Sour Gas - Green
M100KIT 6	Front Protection Lens Replacement Kit (Lens, O-Ring, Retainer Ring)
M100KIT 8	Rear Cap Kit (Rear Cap, S/N Tag, O-Ring, Screws)
M100KIT 9	Foam Replacement Kit
M100SBAT1	HDI Battery Pack - 1 Year Life
M100KIT1502	Sensor Housing Replacement Kit (Hsng, O-Ring, Set Screws)
M100KIT2202	Sensor Housing Replacement Kit (Hsng, O-Ring, Set Screws)
M100EDFL16-K	Electronics Display Front Lens Kit - 16,000 psi
M100EDFL10-K	Electronics Display Front Lens Kit - 10,000 psi
M100EDFL6K	Electronics Display Front Lens Kit - 6,000 psi
M100EDFL45K	Electronics Display Front Lens Kit - 45,000 KPa
M100KIT12	Electronics Assy Kit (Lens, Display, Electronics, Mtg Hardware)

Features

- ► Battery Powered
- ► Sunlight Readable Display
- ► Digital Pressure Readout
- ► Analog Bar Graph Pressure With Divided Scale
- ► Shock And Vibration Proof
- ► No Meter Jitter From Vibration
- ► NIST Traceable Calibration
- ► 1502 And 2202 Pressure Fittings
- ► Intrinsically Safe Weatherproof Enclosure
- ► 6,000 PSI, 10,000 PSI, 16,000 PSI Ranges
- ► Micromachined Piezoresistive Pressure Transducer
- ► 1/4" Scratchproof Clear Front Lens
- ► Safety Yellow

Options

- ► Battery Powered Backlight With Auto-Light Switch
- ► Isolated 4/20 MA 16-Bit Resolution Output
- ► 2"M NPT/1"F NPT Combination Fittings
- ► Guiberson One Inch Fitting, 2" F NPT Fitting
- ► CSA Certificate

Specifications

Dimensions	7.25" O.D. x 4.25" D x 15" H
Weight	25.1 Lbs (As Shown With 1502 Hammer Union)
Case Material	Shock Absorbing Polymer
Internal Calibration Switches	Mode, Up, Down, Enter
Pressure Range	0-6,000 PSIG / 0-10,000 PSIG / 0-16,000 PSIG
Overpressure	Up To 5,000 PSI Range (Optional) - 2X Pressure Range 5,000 to 10,000 PSI - 15,000 PSI Overpressure No Overpressure For 16,000 PSI Range
Power	Intrinsically Safe Sealed Battery Pack
Battery Life	1-Year Continuous Operation
Low Battery Indicator	Battery Shaped ICON
Time Base	Quartz Crystal
Accuracy	0.5% of Full Scale (Linearity, Hysteresis, and Repeatability)
Resolution	10 psi (From 0 psi to Full Scale)
Engineering Units	PSI and KPa
Media Temperature	-30 to 85°C
Storage Temperature	-40 to 85°C
Display	Sunlight Readable LCD with 5-Digit Digital Pressure Display, 101 segment Circular Analog Bar Graph, and Low Battery Icon.
Viewing Angle	6 O'Clock
Viewing Distance	40 Feet
Electronics Protection	Weatherproof Sealed And Mounted In Shock Protection Material
Front Panel Protection	Clear Lens 1/4 Inch Thick With O-Ring Seal
Connections	1502 and 2202 Hammer Unions/2" M NPT & 1" F NPT Combo - 2-5/8" Wrench Flats
Cement Sensor Protection	Primary and Secondary Rubber Diaphragms
Media Pressure Port	Fluids Compatible With 316L Stainless Steel

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